Accuracy of Ultrasound Technique for Confirmation of Endotracheal Intubation by Emergency Medicine Department

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ABSTRACT

BACKGROUND: End tidal CO2 is the gold standard for confirmation of endotracheal intubation but commonly used method in emergency department are five point auscultation and direct visualization method. USG is an alternative technique for confirmation of endotracheal intubation. The study was done to assess the Accuracy of Ultrasound Technique for Confirmation of Endotracheal Intubation. METHODS: A prospective descriptive study of Ultrasound guided endotracheal intubation confirmation of 50 patients presenting to ED was done in BJMC, Ahmedabad after obtaining the consent of patients. Sensitivity and specificity will be calculated. RESULTS & DISCUSSION: Total 50 Intubations were analysed of which 36 were male and 14 were female patients. The sensitivity and specificity for the detection of proper ETT placement with US were: Sensitivity: 98%, Specificity: 100%, Positive Predictive Value: 100%, Negative Predictive Value: 0%. CONCLUSION: Ultrasound imaging of trachea is a useful, quick, non-invasive, portable, and direct anatomic method for confirmation of ET tube position. We think it should be considered the method of choice for the secondary confirmation of the ET tube position.

Key Words: Endotracheal Intubation, Ultrasound Confirmation, Emergency Department.

INTRODUCTION

In patients undergoing emergency tracheal intubation, there is currently no universally accepted gold-standard test to confirm the location of the endotracheal tube (ETT).1 Although continuous end tidal CO2 has become the preferred method, there are still significant risks of false positives with hypopharyngal placement and false negatives during cardiac arrest.1 Moreover, continuous end tidal CO2 monitoring is not widely available in many emergency departments (ED).2 The incidence of esophageal intubation during emergency conditions has been reported to be as high as 8–14%.1 The lack of a single, reliable test to confirm ETT placement can potentially lead to confusion regarding the Location of the tube. This confusion can result in both unrecognized esophageal intubations (“false positive”), as well as successful tracheal intubations that are subsequently removed (“false negative”), subjecting the patient to further unnecessary attempts at airway management. Both scenarios can lead to disastrous consequences. The advent of point-of-care ultrasound (POCUS) has led to a potential solution to this problem. Over the past decade, emergency physicians and others have studied the ability of POCUS to determine ETT location either during or immediately following laryngoscopy.

Figure 1: Two hyperechoic reverberation artifacts inside trachea = tracheal intubation. Tracheal intubation visualized on ultrasound (bullet sign).

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Reverberations are seen in the anterior portion of the lumen of the trachea, just posterior (or deep) to the anterior wall.

**Figure 2:** Two hyperechoic reverberation artifacts inside esophagus = esophageal intubation. “Double Track Sign”

**AIMS AND OBJECTIVES**
To study the Accuracy of Ultrasound Technique for Confirmation of Endotracheal Intubation.

**MATERIALS AND METHODS**
A prospective observational study of Ultrasound guided Endotracheal intubation confirmation of patients presenting to ED was done in B.J. Medical College, civil hospital, Ahmedabad after obtaining the consent of patients or relatives. Total 50 patients admitted in Emergency Department and requiring emergency intubation were included in our study during March to May 2016.

**Inclusion Criteria:** Patients or relatives who gave consent. Age >18 and <80 years.

**Exclusion Criteria:** Patients or relatives who did not give consent. Age <18 and >80 years.

Brief history and clinical examination were noted in preformed Proforma. Intubation was done by 2nd year EM resident and confirmation by ultrasound was done by 3rd year EM resident or faculties. Trans tracheal ultrasound approach was used and was confirmed with 5 point auscultation method, direct visualisation.

**Figure 3:** Transverse placement of the high-frequency linear transducer over the trachea just cephalad to the suprasternal notch.

**RESULTS & DISCUSSION**
Over the period of March to May 2016, 50 Intubations were analysed of which 36 were male and 14 were female patients. In 6 (12%) cases endotracheal tube was found to be in oesophagus which was quickly detected by the help of ultrasound and so endotracheal intubation done thereafter. In 1 (2%) case it was not possible with the help of USG to detect whether tube was in oesophagus or trachea. Total medical cases were 32 and 18 cases were of trauma patients. The sensitivity and specificity for the detection of proper ETT placement with US were:

- **Sensitivity:** 98%
- **Specificity:** 100%
- Positive predictive value (PPV): 100
- Negative predictive value (NPV): 0

**Table 1: Clinical and Demographic data**

<table>
<thead>
<tr>
<th>Clinical and Demographic details</th>
<th>No of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>62.3 ± 12.6</td>
</tr>
<tr>
<td>Male</td>
<td>36</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>8</td>
</tr>
<tr>
<td>Co-morbid conditions</td>
<td>36</td>
</tr>
<tr>
<td>Medical cases</td>
<td>32</td>
</tr>
<tr>
<td>Trauma cases</td>
<td>18</td>
</tr>
</tbody>
</table>

End tidal CO2 is the gold standard for confirmation of endotracheal intubation but commonly used method in emergency department are five point auscultation and direct visualisation method. Ultrasound is an alternative technique, repeatable, non-invasive, and real-time diagnostic tool in many EDs and critical care areas. Michael Gottlieb et al, showed 96.4% sensitivity and 100% specificity. Werner et al, showed 100% sensitivity and specificity for detection of endotracheal intubation with USG which are comparable to our study.

It is quickly performed and may have particular utility in patients in whom secretions or blood obscures visualization of the airway, or patients with limitations in mouth opening precluding the use of a laryngoscope. Jen Tang Sun et al, showed 98.9% sensitivity and 100% specificity which are comparable to our study. Jen Tang San et al, study have provided promising results with tracheal ultrasonography for endotracheal tube position assessment in a cadaver model, and in live humans under a well-controlled environment.
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operating room setting. Jen tang sun et al, demonstrated that tracheal ultrasonography achieved high accuracy for the confirmation of endotracheal tube placement during emergency intubation, including patients with impending respiratory failure, cardiac arrest, and major trauma. Due to obesity there was difficulty in visualisation of tracheal intubation by USG so 1 case was false positive in our study.

CONCLUSIONS
Ultrasound imaging of trachea is a useful, quick, noninvasive, portable, and direct anatomic method for confirmation of ET tube position. We think it should be considered the method of choice for the secondary confirmation of the ET tube position.

REFERENCES